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$$\text{(a)}\quad L=\frac{2a\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}\pi}\sin\theta\cos^2\phi\,d\theta\,d\phi}{\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}\pi}\cos\phi\,d\theta\,d\phi}=\frac{4a}{\pi}\int_0^{\frac{1}{2}\pi}\int_0^{\frac{1}{2}\pi}\sin\theta\cos^2\phi\,d\theta\,d\phi=a.$$

MISCELLANEOUS.

174. Proposed by L. E. DICKSON, Ph. D., Associate Professor of Mathematics, The University of Chicago.

By a linear transformation with integral coefficients modulo 2, reduce $f=\Sigma x_i^2+\Sigma x_ix_j$ $(i, j=1, ..., 2m; i<j)$ to a canonical form in which the variables are separated into pairs.

Solution by the PROPOSER.

Let $x_1=y_1+s$, $x_2=y_2+s$, where $s=\sum_{i=3}^{2m} x_i$. Then (mod 2),

$$f\equiv y_1y_2+y_1^2+y_2^2+F,\quad F=\Sigma\, x_ix_j\ (i, j=3, ..., 2m; i<j).$$

In F, set $x_3=y_3+t$, $x_4=y_4+t$, where $t=\sum_{i=5}^{2m} x_i$. Then

$$F\equiv y_3y_4+G,\quad G=\Sigma\, x_i^2+\Sigma\, x_ix_j\ (i, j=5, ..., 2m; i<j),$$

modulo 2. Since G is of the form f, repetitions of the process evidently lead to the required canonical form.

PROBLEMS FOR SOLUTION.

ALGEBRA.

317. Proposed by FRANCIS RUST, Allegheny, Pa.

Once, in classic days, Silenus lay asleep; a goat skin filled with wine near him. Dionysius passing by, profited, by siezing the skin, and drinking for two-thirds (⅔) of that time in which Silenus alone could have emptied said skin. At this point Silenus awoke, and seeing what was happening, snatched away the precious skin, and finished it.

Now, had both started together, and drank simultaneously, they would have consumed the wine skin in two hours less time. And, in this case, Dionysius' share would have been one-half as much as Silenus did secure, by waking and snatching the skin.

In what time would either one of them alone finish the goat-skin?